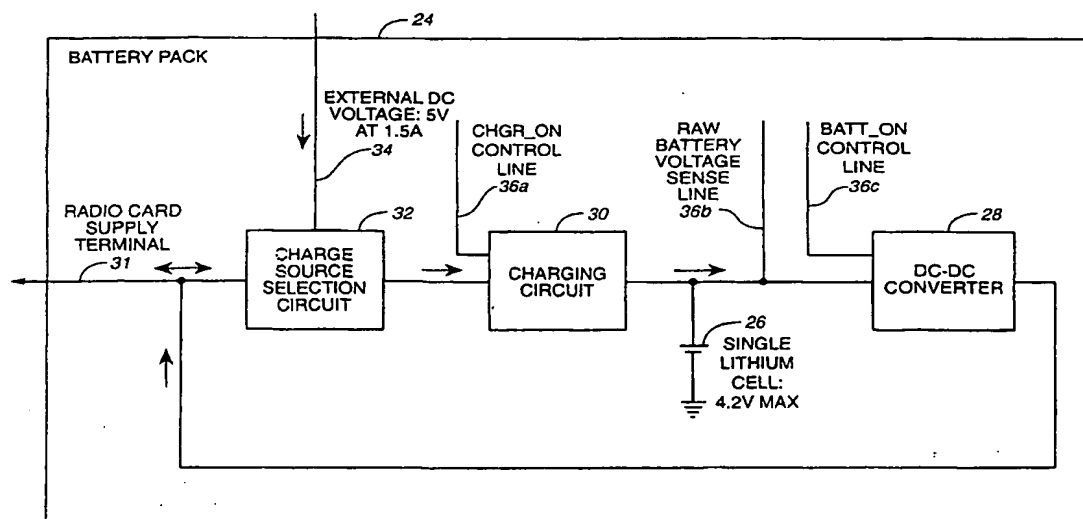




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(21) International Application Number: PCT/CA99/00888 (22) International Filing Date: 24 September 1999 (24.09.99) (30) Priority Data: 09/160,498 24 September 1998 (24.09.98) US (71) Applicant: SIERRA WIRELESS, INC. [CA/CA]; Suite 150, 13575 Commerce Parkway, Richmond, British Columbia V6V 2L1 (CA). (72) Inventor: MILLER, Bruce; 3242 Samuels Court, Coquitlam, British Columbia V3E 1C8 (CA). (74) Agent: VERMETTE & CO.; Granville Square, 230 - 200 Granville Street, P.O. Box 40, Vancouver, British Columbia V6C 1S4 (CA).		(81) Designated States: CA, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report.</i>

(54) Title: SMART PERSONAL COMPUTER CARD BATTERY PACK



(57) Abstract

The invention generally relates to a detachable battery pack (24) for use with a personal computer card. In one embodiment, the battery pack (24) can be recharged from a DC power source or from a personal computer. In another embodiment, an external DC power (34) source is used to recharge the battery while concurrently powering the personal computer card. In yet another embodiment, the detachable battery pack (24) can be recharged while the battery pack (24) is connected or unconnected to the personal computer card. The use of a battery pack for the personal computer card allows the elements of the personal computer card to be powered without requiring significant amount of power from the handheld personal computer.

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SMART PERSONAL COMPUTER CARD BATTERY PACK

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to personal computer (PC) cards used with
5 personal computers, particularly to the power management of PC cards.

State of the Art

PC cards are a common way to add peripheral devices to a personal
computer. Elements such as memory or communication devices, can be placed on
a PC card having a standard interface with a personal computer. A common
10 interface standard for PC cards is the Personal Computer Memory Card Interface
Association (PCMCIA) standard. PC cards are typically powered by the personal
computer. This causes no problems when the PC cards are used with desktop
computers attached to a wall outlet. This can cause problems, however, when the
PC cards are used with portable computers, especially handheld personal
15 computers. For example, some handheld personal computers are powered by two
AA batteries, and thus there is little spare current for power-using elements on the
PC card. This can effectively limit the types of PC cards used with the handheld
computers.

For this reason, it is desired to have an improved way of powering PC
20 cards, especially PC cards used with handheld personal computers.

Summary of the Present Invention

The present invention, generally speaking, comprises a detachable battery
pack used for PC cards. In one embodiment of the present invention, the battery
pack can be selectively recharged from a DC power adapter or from the personal

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computer when the personal computer is connected to a DC power adapter. This provides for flexibility in recharging the battery pack which is important because of power requirements of the PC card.

5 In another embodiment of the present invention, the detachable battery pack can be connected to an external DC power supply and the DC power supply can both recharge the battery and supply power to the PC card. This helps keep the battery pack fully charged. The detachable battery pack can preferably be recharged either when the battery pack is connected to the PC card or when the battery pack is removed from the PC card.

10 One advantage of the detachable battery pack of the present invention is that it allows the PC card to have power-using elements, such as a radio transceiver, which could not otherwise be powered by a handheld personal computer. This is especially an advantage when the handheld personal computer is powered by two AA batteries and thus has little spare current to power the PC
15 card.

Brief Description of the Drawings

The present invention may be further understood from the following description in conjunction with the appended drawings. In the drawings:

20 Figure 1 is a block diagram of the personal computer, PC card and detachable battery pack.

Figure 2 is a block diagram of the battery pack of the present invention.

Figure 3 is block diagram of the power management system used with the PC card connected to the handheld personal computer and detachable battery.

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Detailed Description of the Preferred Embodiment

Figure 1 is a block diagram showing the personal computer 20, PC card 22, and battery pack 24. The personal computer 20 can be a handheld personal

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computer. Often, handheld computers run on relatively weak power supplies, such as two AA batteries. Such handheld personal computers have little current to spare for other uses.

In one embodiment, the handheld personal computer 20 runs an operating system that allows software dedicated to the PC card 22 to operate. For example, the handheld personal computer 20 can be of the type that runs the Windows CE[®] operating system, such as a Casio, HP and Sharp handheld personal computer.

The PC card 22 contains a power-using element. In one embodiment, the PC card 22 is a cellular modem with a built-in radio transceiver. In a preferred embodiment, the radio transceiver is of the type that transfers Cellular Digital Packet Data (CDPD). This allows a handheld personal computer to send E-mail, connect to the Internet, or do a wide range of information retrieval services. During full operation, the cellular modem radio transceiver requires 600 milliamps at 5 volts. This power requirement would quickly run down the 2 AA batteries of some handheld personal computers.

Figure 2 is a block diagram showing the battery pack 24 of the present invention. Battery pack 22 preferably has battery cell 26. In a preferred embodiment, this battery cell is a lithium-ion battery cell. The lithium-ion battery cell of this preferred embodiment produces a 4.2 volts maximum, 3.7 volts nominal, unregulated voltage. Battery cell 22 has a 900 mAh capacity, producing 30 minutes to an hour of continuous use when used to power a cellular modem. This results in a few days' use under typical CDPD user conditions.

The battery cell 26 is connected to DC-DC converter 28. DC-DC converter 28 produces a regulated 5 volt output. Charging circuitry 30 is used to recharge the battery cell 26. When a lithium-ion battery cell is used, the charging circuit 30 will reduce the recharging current as the battery approaches its full charge. Charging circuits used to recharge lithium battery cells are well known in the art.

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The charge selection circuitry 32 is used to select the source of power used to recharge the battery cell 26. If an external DC power source is connected along line 34, then this power source is sent to the charging circuitry 30, and thus to the battery cell 26. Alternately, power from the personal computer by way of the PC card can be selected by the selection circuitry 32.

In this way, the battery cell 26 can be recharged either with the external DC voltage or by using power from the personal computer. Power from the personal computer would typically be used only when the personal computer is connected to a DC wall adaptor.

The charge selection circuitry 32 can detect whether the DC wall adapter is connected to the battery pack. If the DC wall adapter is connected, charge is sent out line 31 to the PC card to energize the power-using element in addition to sending charge to the charging circuitry 30. In one embodiment, battery pack 22 includes control lines connected to the personal computer. Control line 36a controls whether the battery cell is to be recharged. Control line 36b is a raw battery voltage sense line which indicates the voltage of the battery cell 26. Control line 36c is a battery on/off control line. This line can be used to turn the power from the battery pack on and off. The interconnection of the battery pack 22 with the rest of the PC card is shown below in Figure 3.

In a preferred embodiment, the battery pack can be recharged in a number of ways.

1) When the battery pack is connected to PC card socket, but not in active use, the battery can draw a small amount of power from the handheld personal computer (typically 200 mA at 5 volts.) This will recharge the lithium cell in 5-6 hours. However, this method is only feasible if the handheld personal computer is powered from an external wall adaptor. Otherwise, the handheld personal computer's battery would become depleted trying to recharge the lithium cell.

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from the external DC voltage to both the personal computer card and the battery cell.

13. The battery pack of claim 12, wherein the charge source selection circuitry can direct power from the personal computer card to recharge the battery
5 cell.

14. The battery pack of claim 12, wherein the battery pack is rechargeable from the external source of DC voltage while detached from the rest of the personal computer card.

15 15. The battery pack of claim 12, wherein the battery pack includes a charging circuit for controlling the charging rate of the battery cell.

16. The battery pack of claim 12, wherein the battery pack can be recharged from an external source of DC voltage connected to the battery pack or from a personal computer connected to the personal computer card at a personal computer card socket.

15 17. The battery pack of claim 12, wherein the external source of DC power is a wall outlet adapter.

18. The battery pack of claim 12, wherein the battery pack is detachable from the personal computer card.

20 19. A battery pack comprising:
a battery cell;

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a first connection for connecting the battery pack to a personal computer card so that the battery cell can supply power to the personal computer card; and
a second connection for connecting the battery pack to an external source of DC voltage, wherein the battery cell can be recharged from the external source of DC voltage; and wherein the battery pack is detachable from the personal computer card and the battery cell is rechargeable with the external source of DC voltage whether or not the battery pack is connected to the personal computer card.

20. The battery pack of claim 19, wherein the battery pack can be recharged from an external source of DC voltage connected to the battery pack or from a personal computer connected to the personal computer card at a personal computer card socket.

21. The battery pack of claim 19, wherein the battery pack includes charge source selection circuitry operably connected to the battery cell, the charge source selection circuitry including a connection port for connecting to personal computer card and a connection port for connecting to an external DC voltage, wherein when the battery pack is connected to the external DC voltage and to the personal computer card, the charge selecting circuitry can direct power from the external DC voltage to both the personal computer card and to recharge the battery cell.

22. The battery pack of claim 21, wherein the charge source selection circuitry can direct power from the personal computer card to recharge the battery cell.

23. The battery pack of claim 19, wherein the battery pack includes a charging circuit for controlling the charging rate of the battery cell.

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2) The battery pack can be removed from the PC card and plugged into its own wall adaptor. Because the circuitry to recharge the battery is present within the pack, this will fast charge the cell in about two hours. The user can carry two battery packs around with the handheld personal computer: one can be recharging while the other is in active use. This fast recharge also works if the battery pack is plugged into its own wall adapter while plugged into the PC card, but the PC card is not connected to the handheld personal computer.

3) The external wall adaptor can be plugged into the battery pack while the pack is plugged into the PC card and the PC card is present in the handheld personal computer socket. In this mode of operation, the wall adaptor acts as a battery eliminator and can power the card indefinitely. The battery will be recharged at either 200 mA or 600 mA, depending of the power rating of the DC adaptor and the modem card's current operating state, while the external wall adaptor continues to power the PC card.

Figure 3 is a block diagram illustrating the PC card 22 connected to the handheld personal computer 20. A detailed description of the power management system shown in Figure 3 is given in the patent application "Personal Computer Card Power Management System", inventor Bruce Miller, Serial No. 09/160,501 (corresponding to attorney docket number 024938-078), which is incorporated herein by reference. Control lines 36 are connected between the detachable battery pack 24 and the power controller 38. These include the control lines 36a-c described with respect to Figure 2 above and a control line which indicates the presence of the adapter 34. The power management controller 38 is preferably a PC card interface allowing software running on the personal computer to control the power management system.

The power management controller 38 is also used to control the power switch 40. Power switch 40 is preferably a low-loss transistor. Power switch 40 allows power from the handheld personal computer to go to the radio transceiver

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42 and also to the detachable battery pack 24, and thus possibly be used for recharging the detachable battery pack 24. The radio transceiver 42 can thus be powered by the battery pack, an external DC wall adaptor or the handheld personal computer 20. PC card 22 is connected to the handheld personal computer 20 by
5 socket 44 which includes power line 44a and control lines 44b.

It will be appreciated by those of ordinary skill in the art that the invention can be embodied in other specific forms without departing from the spirit or central character thereof. For example, although one of the preferred
10 embodiments is described with respect to a radio transceiver, any power-using element on the PC card could also be used. Furthermore, although in a preferred embodiment, the power management controller is a PC card interface, the power management controller could be a dedicated processor. Furthermore, additional logic can be added to the detachable battery pack to control the battery recharging and power output, rather than relying on the control line 36 from the PC card
15 interface. Additionally, although a detachable battery pack is used in the preferred embodiment, for some of the embodiments of the present invention a battery pack integrally formed with the PC card could be used.

The presently disclosed embodiments are therefore considered, in all respects, to be illustrative and not restrictive. The scope of the invention is
20 indicated by the appended claims, rather than the foregoing description, and all changes which come within the meaning and range of equivalents thereof, are intended to be embraced therein.

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24. The battery pack of claim 19, wherein the battery pack can be recharged from an external source of DC voltage connected to the battery pack or from a personal computer connected to the personal computer card at a personal computer card socket.

5 25. The battery pack of claim 19, wherein the external source of DC power is a wall outlet adapter.

26. The battery pack of claim 19, wherein the battery pack is attachable and detachable from a personal computer card.

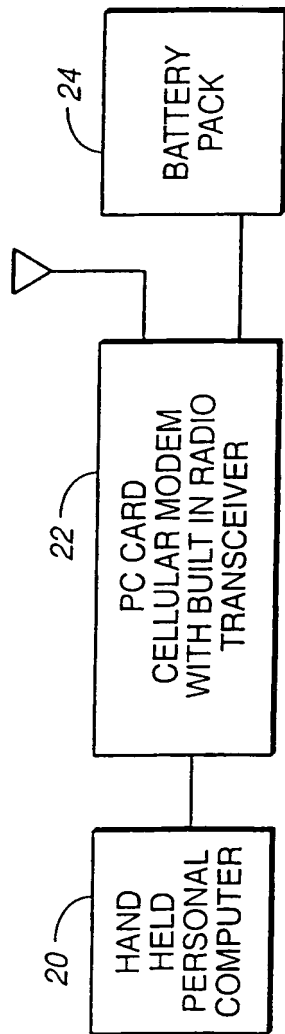


FIG. 1

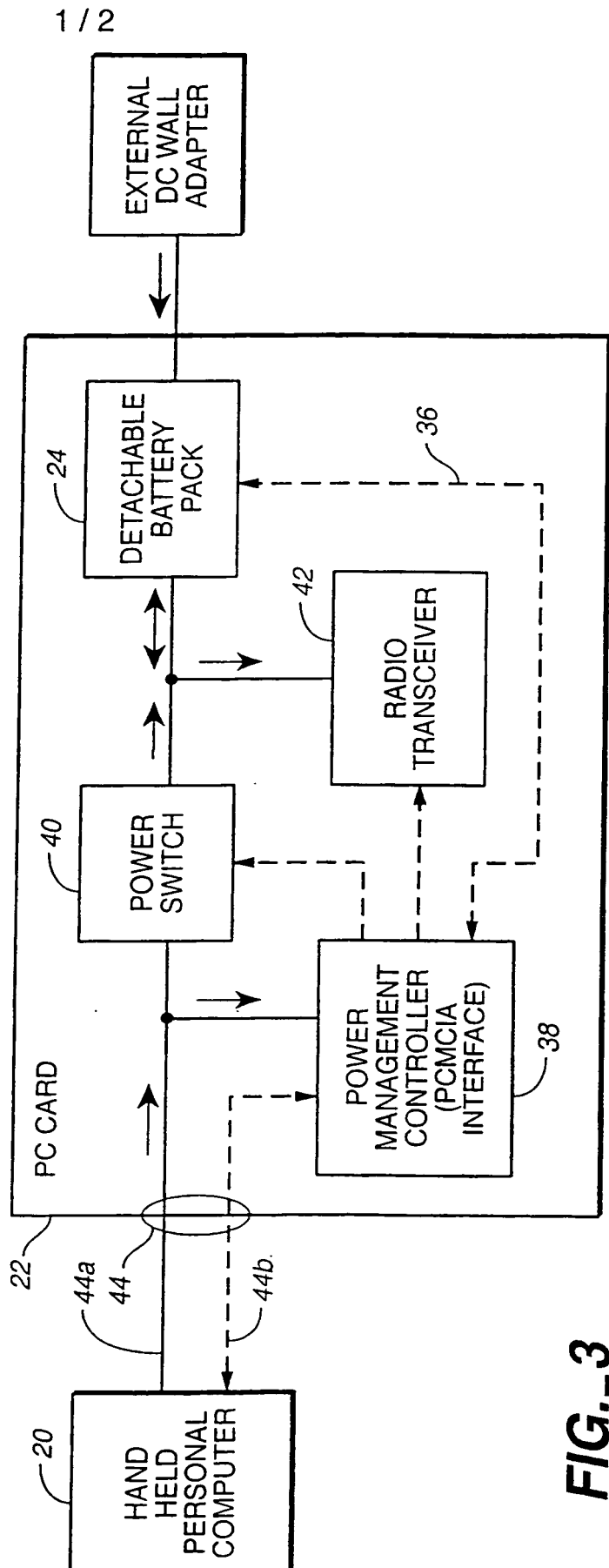


FIG. 3

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Claims:

1. A personal computer card comprising:
a power-using element; and
a detachable battery pack, the detachable battery pack including a battery
cell, the battery pack adapted to supply charge to the power-using element,
5 wherein the battery pack is rechargeable from an external source of DC voltage
connected to the battery pack or from a personal computer connected to the
personal computer card at a personal computer card socket.
2. The personal computer card of claim 1, wherein the battery pack is
rechargeable from the external source of DC voltage while detached from the
10 remainder of the personal computer card.
3. The personal computer card of claim 1, wherein the battery pack
includes charge source selection circuitry operably connected to the battery cell,
the charge source selection circuitry including a connection port for connecting to
personal computer card and a connection port for connecting to an external DC
15 voltage, wherein when the battery pack is connected to the external DC voltage
and to the personal computer card, the charge selecting circuitry can direct power
from the external DC voltage to both the personal computer card and the battery
cell.
4. The personal computer card of claim 3, wherein the charge source
20 selection circuitry can direct power from the personal computer card to recharge
the battery cell.

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5. The personal computer card of claim 1, wherein the battery pack includes a charging circuit for controlling the charging rate of the battery cell.

6. The personal computer card of claim 1, wherein the battery cell is a lithium battery cell.

5 7. The personal computer card of claim 1, wherein the personal computer card is a radio modem card.

8. The personal computer card of claim 1, wherein the power-using element is a radio transceiver.

9. The personal computer card of claim 1, wherein the personal computer
10 card comprises a PCMCIA card.

10. The personal computer card of claim 1, wherein the personal computer card includes a power controller.

11. The personal computer card of claim 1, wherein the external source of DC power is a wall outlet adapter.

15 12. A battery pack comprising:
 a battery cell; and

 charge source selection circuitry operably connected to the battery cell, the
charge source selection circuitry including a connection port for connecting to a
personal computer card and a connection port for connecting to an external DC
20 voltage, wherein when the battery pack is connected to the external DC voltage
and to the personal computer card, the charge selecting circuitry can direct power

INTERNATIONAL SEARCH REPORT

Int .tional Application No

PCT/CA 99/00888

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	US 5 350 640 A (MASUI KEIJI) 27 September 1994 (1994-09-27) abstract column 1, line 5 -column 3, line 66	2 1, 10, 12-14, 16-21, 23, 24, 26
Y A	US 5 706 239 A (BRYN WIESLAW) 6 January 1998 (1998-01-06) abstract column 1, line 42 -column 2, line 43 column 4, line 44 -column 5, line 33 claims 2, 4, 5	5, 9, 10 1, 3, 4, 6, 11, 12, 15, 17, 19-21, 23-26
Y A	US 5 451 933 A (STRICKLIN DOUGLAS M ET AL) 19 September 1995 (1995-09-19) abstract column 1, line 9 -column 3, line 25 claims 5, 6, 9	7, 8, 11 1, 3, 9, 10, 12, 17, 19, 25

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/CA 99/00888

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 9516940	A	22-06-1995	JP 7201187 A EP 0734546 A US 5761061 A	04-08-1995 02-10-1996 02-06-1998
US 5350640	A	27-09-1994	JP 4359872 A	14-12-1992
US 5706239	A	06-01-1998	NONE	
US 5451933	A	19-09-1995	NONE	

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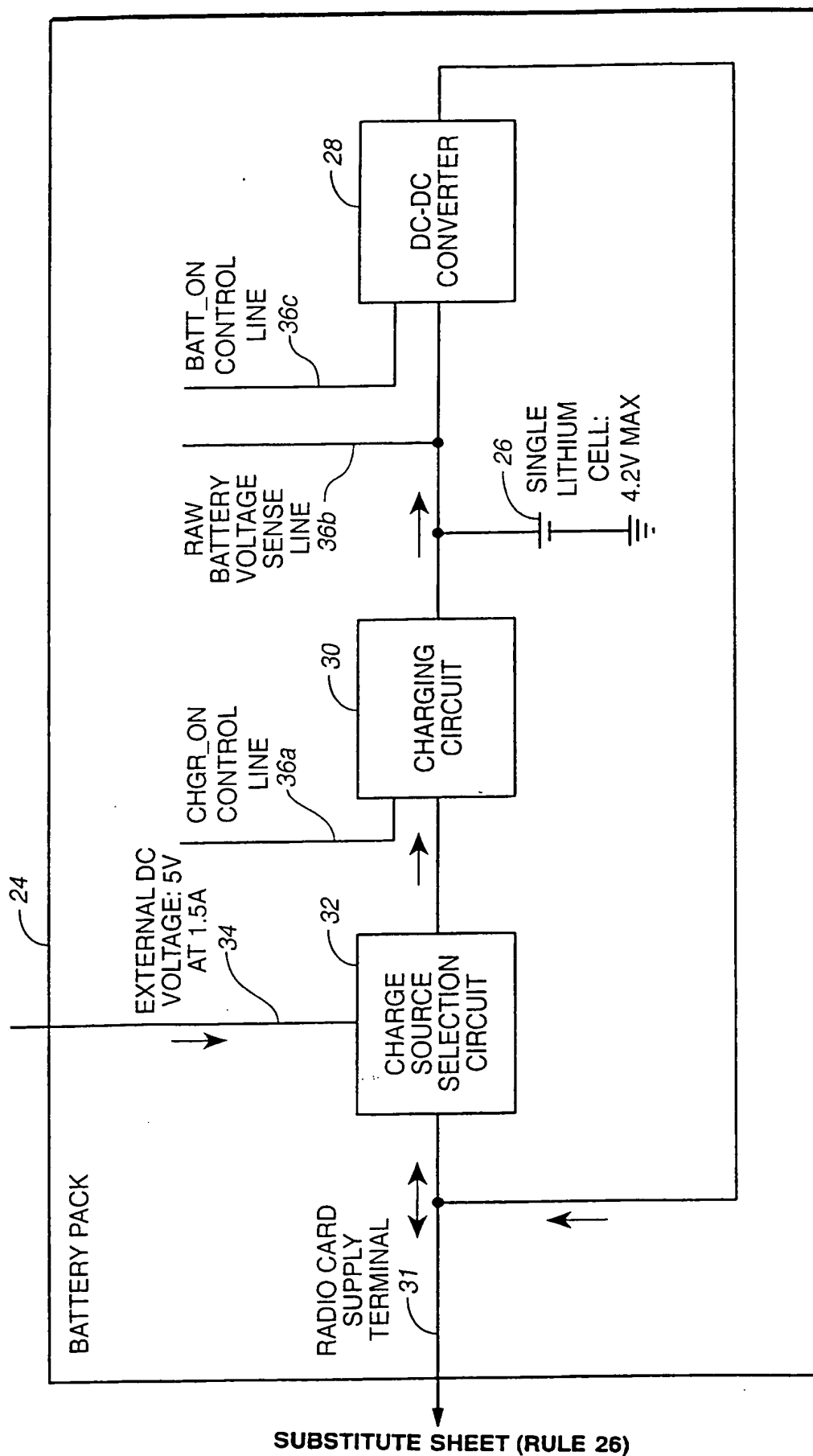


FIG. 2

INTERNATIONAL SEARCH REPORT

Int. Application No.

PCT/CA 99/00888

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 G06K19/07 G06K7/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G06K G11C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A	<p>WO 95 16940 A (AMANO KAZUTOSHI ;BERG TECH INC (US)) 22 June 1995 (1995-06-22)</p> <p>page 2, line 27 -page 4, line 30 page 5, line 12 -page 7, line 17 claims 7,11; figure 1</p> <p style="text-align: center;">— -/—</p>	<p>1,6</p> <p>2,5,7-11 3,4, 12-14, 16-20, 22,25,26</p>

☒ Further documents are listed in the continuation of box C.

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Date of the actual completion of the international search

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16 December 1999

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